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(71) Applicants
Metal Closures Venus Packaging Limited,
(Great Britain),
Lower Middleton Street,
Ilkeston,
Derbyshire,
DE7 5TS.
(72) Inventors
James William Sinclair
(74) Agent and/or Address for Service
Eric Potter and Clarkson,
14 Oxford Street,
Nottingham,
NG1 5BP.

(54) **Tearable plastic film**

(57) A plastics film which is readily tearable in one direction, the film including a cellular layer of elongate bubbles, the bubbles being closely spaced and aligned with their longitudinal axes extending generally parallel to one another and said direction so as to guide tearing in said direction. The film is made by extruding a sheet of the plastics material while foaming a layer thereof so as to create a layer of the above bubbles which are then elongated as above.

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The drawings originally filed were informal and the print here reproduced is taken from a later filed formal copy.

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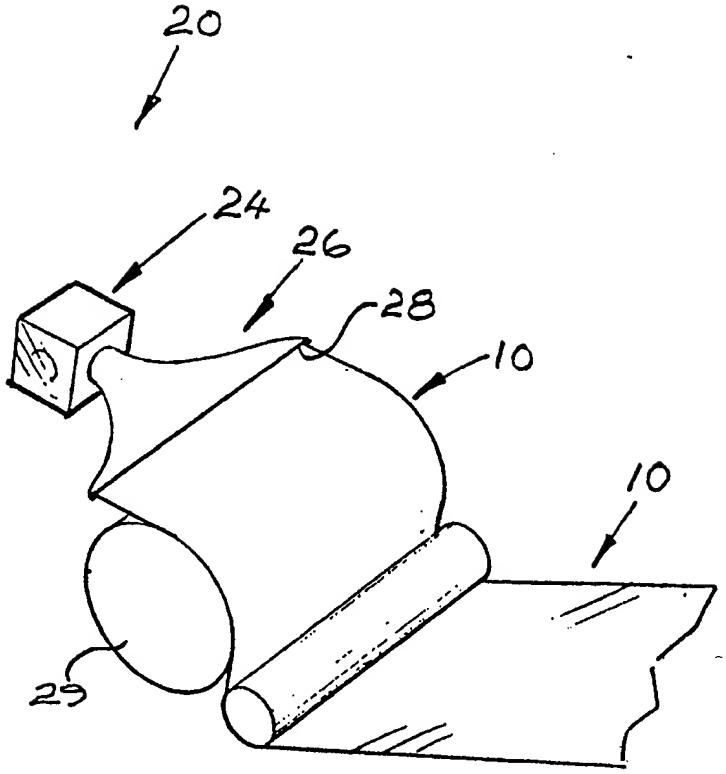

Fig. 1

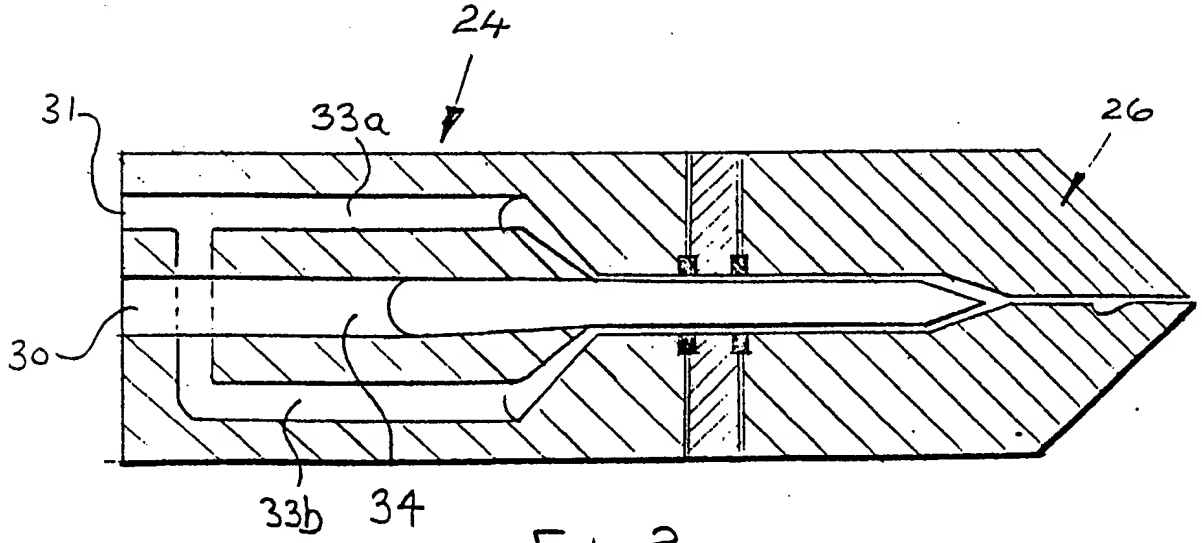

Fig. 2

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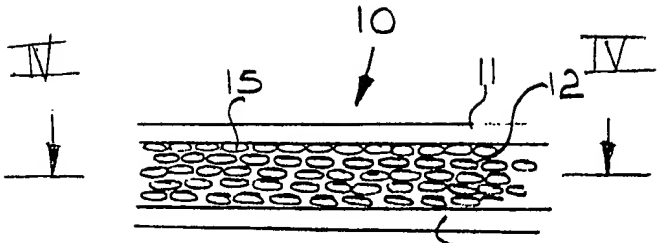

Fig.3

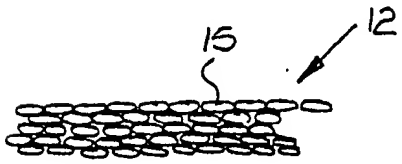

Fig.4

SPECIFICATION

A plastic film

The present invention relates to a plastics film and its production.

In this specification a film is a single layer or a number of superimposed layers of plastics material(s) having a total thickness of less than about 250 microns.

Bags are commonly made from polyethylene film and are sealed to provide a sealed enclosure for articles contained within the bag.

The problem associated with such bags, and also associated with bags made of a similar material such as polypropylene film, is that they are awkward or difficult to open by tearing since the plastics film does not readily rip in any particular direction. This is particularly disadvantageous in situations where quick access into a bag is required as for instance for bags used in hospitals.

It is a general aim of the present invention to provide a plastics film which readily tears in one direction. Accordingly bags made of such a film can be opened easily and quickly by a tearing action.

Ascording to one aspect of the present invention there is provided a plastics film which is readily tearable in one direction, the film including a cellular layer of elongate bubbles, the bubbles being closely spaced and aligned with their longitudinal axes extending generally parallel to one another and said direction so as to guide tearing in said direction.

Preferably the plastics film is a co-extrusion having at least three layers wherein the central payer is defined by the cellular layer. Conveniently the layers are all formed from the same plastics material although it is envisaged that different plastics material may be used for different layers.

According to another aspect of the present invention there is provided a method of producing a plastics film which is readily tearable in one direction, the method including extruding the plastics material in planar sheet form and during extrusion foaming a layer of plastics material to create a layer of closely spaced bubbles, the extrudate being treated so as to elongate the bubbles so that their longitudinal axes are generally parallel to said direction.

Various aspects of the present invention are hereinafter described with reference to the accompanying drawings in which:

Figure 1 is a schematic perspective view of an apparatus arranged to produce a plastics film according to the present invention;

Figure 2 is a schematic section through an extrusion die capable of producing a plastics film according to the present invention;

Figure 3 is a schematic cross-section through a film according to the present invention; and

Figure 4 is a schematic section taken along line IV-IV in Figure 3.

Referring initially to Figures 3 and 4 there is shown a plastics film 10 which is composed of three discrete co-extruded layers 11, 12 and 13. The central layer 12 is a foamed cellular layer having a plurality of closely spaced elongate bubbles or cavities 15. Preferably the population of bubbles created is such as to give the cellular layer 12 an apparent density of less then 0.7 g/cm^3, more preferably in the range of 0.5 to 0.6 g/cm^3.

The relative thicknesses of layers 11, 12 and 13 are chosen so that the direction of tearing of the film 10 is determined by layer 12. Accordingly since all the cavities 15 have their longitudinal axes aligned in generally the same direction tearing of layer 12 is easier in that direction than any other direction.

When the cellular layer 12 forms part of a multi-layered film, as for instance illustrated at 10 in Figure 3, the relative thicknesses of the layers 11, 12 and 13 are chosen so that the combined resistance to tear is substantially less in the direction of elongation of the bubbles than in a direction transverse thereto. For instance, for a 65 micron thick film 10 composed of low density polyethylene the tear strength in the longitudinal direction is in the order of 0.9 Newtons force whereas in the transverse direction it is in the order of 4.0 Newtons force.

The relative thicknesses of the layers are thus chosen so that the tear direction is dictated by the cellular layer. By way of illustration it has been found that if the film 10 has a thickness of 100 microns or less, for example 50 to 100 microns and the film is entirely composed of low density polyethylene then the cellular layer should form at least 35% by weight, preferably 40% or more by weight, of the total weight of the film. If the film is of a thickness in excess of 100 microns, preferably the cellular layer forms at least 50% by weight of the total weight of the film 10.

If, for instance, layers 11 and 13 are formed from a plastics material which is stronger than low density polyethylene, such as polypropylene, the weight of the cellular layer is preferably about 50% of the total weight of the film for a film having a thickness between 50-100 microns.

If the cellular layer 12 is formed from a stronger more resilient material than low density polyethylene, for example an ethylene vinyl acetate co-polymer (9% vinyl acetate) and the outer layers 11, 13 are formed from polypropylene it has been found that the cellular layer in such a construction should from at least 75% by weight of the total weight of the film 10 when the film 10 has a thickness ranging between 50-100 microns.

Although film 10 is shown in Figure 1 as a multi-layered film it is envisaged that either layer 11 or 13 or both may be omitted. However it is presently preferred to have a three layered film as shown since layers 11 and 13 isolate layer 12 from the walls of the extruding die which has an advantage of preventing build up of plastics material at the die opening which would otherwise occur.

In Figures 1 and 2 an extruding apparatus 20 capable of producing film 10 is shown schematically. The apparatus 20 includes an extruding die arrangement 25 which includes a flow combining chamber 24 and a die 26. The die 26 expands in width from the combining chamber 24 to terminate in an elongate orific 28. The die 26 and flow mixing chamber 24 are conveniently of conventional construction.

The extruded film 10 is directed onto a water cooled roller 29 and is then drawn of roller 29 to be wound into a roll (not shown).

In Figure 2 the relative paths of flow of the plastics material determined by the flow combining chamber are shown. The output from one flow of plastics material enters through port 30 and another flow of plastics material enters through port 31. The flow 33 from port 31 divides into two flows 33*a* and 33*b* and meet on either side of flow 34 from port 30 at a location 36 prior to entry into the die 26.

The plastics material entering port 30 has mixed therewith a heat sensitive foaming agent such as an azodicarbonamide. The foaming agent preferably forms between 0.5 to 0.75% by weight of the weight of the cellular layer. The foaming agent is chosen so that it reaches its activation temperature before extrusion from the die 26. When the foaming agent is within flow combining chamber 24 and die 26 although it has reached activation temperature the plastics material does not foam due to the pressure within the flow of plastics material. Accordingly as soon as the plastics material emerges from orifice 28 of die 26 there is a sudden pressure reduction enabling the plastics material to foam. The plastics film 10 is drawn from the die 26 at a controlled rate by roller 29 and the pulling effect created by roller 29 causes the bubbles formed on foaming of the plastics material 12 to elongate in the direction of the pulling.

Accordingly the degree of elongation of the bubbles may be varied by varying the pulling effect created by roller 29. It is presently preferred to have a draw off rate in the range of 10-100 metres per minute.

Layers 11, 12 and 13 as described above may be each formed from the same plastics material such as low density polyethylene or may be of different plastics material.

Although layers 11, 12, 13 are described as being co-extruded it will be appreciated that these layers may be separately extruded and then secured together to form a laminated film.

Additionally it may be appreciated that any desired number of layers may be co-extruded to provide a film according to the present invention, the film including is desired more than one layer of elongate bubbles.

CLAIMS

1. A plastics film which is readily tearable in one direction, the film including a cellular layer of elongate bubbles, the bubbles being closely spaced and aligned with their longitudinal axes extending generally parallel to one another and said direction so as to guide tearing In said direction.

2. A plastics film according to Claim 1 wherein the film is a co-extrusion including said cellular layer and at least one other layer, the layers being constructed so that the combined resistance to tear of said layers is less in said direction than in a direction transv rse thereto.

3. A plastics film according to Claim 2 wherein the film is a co-extrusion comprised of three layers, said cellular layer forming the central layer.

4. A plastics film according to Claim 2 or 3 wherein all layers of the co-extrusion are formed from the same plastics material.

5. A plastics film according to Claim 2 or 3 wherein said cellular layer is formed from a plastics material different to the plastics material of at least one of the other layers.

6. A plastics film according to any preceding claim wherein the cellular layer is formed from polyethylene and the density of the cellular layer is less than 0.7 g/cm^3.

7. A plastics film according to Claim 6 wherein the density of the cellular layer is in the range of 0.5 to 0.6 g/cm^3.

8. A plastics film according to any of Claims 2 to 7 wherein the cellular layer forms at least 35% by weight of the total weight of said film.

9. A plastics film according to Claim 8 wherein the total thickness of said film is up to 100 microns and said cellular layer forms about 40% by weight of the total weight of the film.

10. A plastics film according to Claim 8 wherein the total thickness of said film is between 100 to 250 microns and said cellular layer forms more than 40% by weight of the total weight of said film.

11. A plastics film substantially as described herein with reference to any of the accompanying drawings.

12. A bag or container formed from a plastics film according to any preceding claim.

13. A method of producing a plastics film which is readily tearable in one direction, the method including extruding the plastics material in planar sheet form and during extrusion foaming a layer of plastics material to create a layer of closely spaced bubbles, the extrudate being treated so as to elongate the bubbles so that their longitudinal axes are generally parallel to said direction.

14. A method according to Claim 13 wherein elongation of said bubbles is achieved by stretching the extrudate in the direction of take-off.

15. A method of producing a plastics film substantially as described with reference to any of the drawings.

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